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ASTRÆA.

Liverpool. Equatoreal. (Mr. Hartnup.)

1850.	Greenwich M.T. h m s	R.A. h m s	N.P.D. ° ′ ″
Feb. 13	7 12 38·4	3 14 28·96	77 19 64·6
	7 32 36·1	29·91	58·5
	7 52 34·5	30·84	51·7
	8 12 32·4	3 14 31·80	77 19 46·5

"The planet was compared with 5 *Tauri;* each determination is from a transit over five wires and the readings of two microscopes. The place of the star is from the Greenwich catalogue."

HEBE.

Hamburg. (M. C. Rümker.)

1850.	Hamburg M.T.	R.A.	Dec.
Feb. 22	$11^h 41^m 57^s \cdot 6$	201° 55′ 5″·9	+ 6° 32′ 40″·0

"Apparent place of star of comparison was,

R.A. $13^h 25^m 36^s \cdot 82$ Dec. + 6° 37′ 22″·9

"This star was observed by Bessel once, and is 25050, 25054 of the Lalande catalogue. The R.A. of 25034 is erroneous 6^s in the catalogue."

Observations made during a Transit of the Fourth Satellite of Jupiter and its Shadow over the Disk of the Planet. By Mr. Lassell.

1850, Feb. 28. "After an intensely cloudy day, the sky suddenly cleared at about 10^h mean time; but on directing the large equatoreal to *Jupiter,* I found the air very disturbed, and unfit for either large power or aperture. I therefore went into the smaller dome, and pointed the 9-foot equatoreal to *Jupiter,* power 222.

"$11^h 48^m$, G.M.T. The 1st satellite is eclipsed; the 2d is receding eastward; the shadow of the 4th is on the face, and the satellite approaching the disk. (For brevity's sake I will designate the satellites simply by their appropriate numerals.)

"There is a striking difference in the brightness of 2 and 4: 4 is of a dull pale colour compared with 2, presenting a much greater contrast than can be supposed to arise from its greater proximity to *Jupiter.* The air is very unfavourable, the planet dancing and shuddering so that I cannot endure power 291. I do not think, after minute attention, that the *disk* of 2 is quite so large as that of 4, though, at first, the superior brightness of 2 vividly suggests the notion that it is so; 4 appears *round,* as well as 2, but 3 (*much* larger than 2) is oblong or irregular.

"$12^h 11^m$. The shadow and satellite being now equally distant

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from the limb, the greater size of the shadow is most obvious; indeed it appears to be twice as great in diameter.

"13^h 10^m. The first satellite has now emerged, and is about three-fourths of its diameter distant from the limb.

"With 20-foot equatoreal, power 297, I measured the distance of the centre of the shadow of 4 from *Jupiter's* southern limb = 33″·88. Distance of shadow from northern limb = 8″·72.

h m s
13 24 0. The fourth satellite is entered upon the face, about one-third of its diameter.
13 28 0. The disk of the satellite is, I think, bisected by the limb of the planet.
13 30 49. I can just see a piece of the satellite projecting, perhaps a bare third of its diameter. The state of the air is, however, very unfavourable.
13 34 0. I have now lost sight of the satellite.
13 42 42. I begin to see again the satellite as a dusky spot on the face of *Jupiter*, near where the satellite entered.
13 46 7. It is very plain. The spot is very small, not half the diameter of the shadow. A well-defined belt is near the northern limb of *Jupiter*.
13 49 0. The satellite is entered on a course across the planet, which will apparently bring it twice as near to the northern limb as the shadow has been.
13 51 0. The satellite is fully two of its diameters within the limb. The second satellite is obviously brighter and larger than the first. Air increasingly disturbed.
14 6 0. The shadow is just touching the southern part of the belt; and the satellite, though fairly within it, is near its northern edge.
14 23 0. The shadow and satellite are now equally near the preceding and following limbs.
14 35 0. The satellite is now advanced four-tenths across the disk, and the shadow approaching the preceding limb.

"Measured the distance of the satellite from northern limb: mean of three measures = 5″·50.

"In the absence of the shadow I should certainly call the satellite a *black spot;* but when compared with the shadow, its blackness is certainly much less intense. I should estimate the satellite now to be rather more than half the diameter of the shadow; the best estimate I can form is that one is double the *area* of the other. The satellite does not appear to me otherwise than *round*, so far as the agitated sky will allow me to judge. Although the satellite entered upon a belt in transiting the planet, it was never visible as a *bright* spot, though the other satellites appear almost universally as bright spots when only just entered within the limb. When the

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satellite was about half across the disk, the sky became so increasingly tremulous that I found it useless to continue observing.

"1850, March 5. The early part of the evening was quite cloudy, but about 10^h *Jupiter* appeared, shining through haze.

"At 10^h 30^m, G.M.T., the shadow and satellite are both visible, rather more than half across the disk, the shadow as a perfectly round black spot. The satellite is a small, irregular, *dusky spot*, about two diameters of the shadow north-following. Twenty-foot equatoreal employed, power 297. The satellite elongated N. and S., and not half the diameter of the shadow. The circumstances were bad, *Jupiter* never being clear during the entire transit. I made six measures, with the Munich parallel wire-micrometer, of the diameter of the shadow, the mean of which is 1$''$·537.

"At 11^h 50^m 57^s·5 the shadow was bisected by the planet's limb.

"At 12^h 6^m 41^s·5 the satellite was bisected by the limb. The shadow and satellite passed over a pretty bright part of *Jupiter's* disk, a little north of the principal northern belt; yet, when the preceding limb of the shadow was nearly touching the limb of *Jupiter*, I lost sight of the satellite, and shortly afterwards recognised it as a *bright spot*, when still clearly within the planet's disk. When the preceding limbs of the satellite and planet were coincident, the satellite appeared very well defined as a bright spot, of far greater magnitude than it had when seen as a dusky spot.

"At 12^h 15^m the sky completely clouded.

Remarks.

"The phenomenon of the dusky spot, in the case of the third satellite, being changed into a bright one when near *Jupiter's* limb, seems to indicate a far greater difference of brightness between the central and circumferential parts of *Jupiter* than the unaided sense of vision would indicate; also that the fourth satellite, not exhibiting such a change even when less contrasted by transiting along a belt, must reflect very little light or have a great part of its surface covered by shades. Its roundness seems to indicate that such shades or markings must be distributed pretty evenly over its surface, and yet on this hypothesis it is difficult to explain its smallness in comparison with the shadow. Can it be that, as suggested by the comparative dulness of *Jupiter's* circumference, the central parts alone of the satellite reflect sufficient light to affect our vision?

"The sky on the 28th of February was so disturbed that I did not think that any measures of the diameter of the shadow of 4 could be got with reasonable accuracy; but, as far as I could estimate its size, I should deem it somewhat larger than the shadow of the third satellite, measured on the 5th of March. Taking it, however, at the same size, and supposing the measure of 1$''$·50 to be correct, I make the resulting diameter of the shadow to be 3027 miles, and the diameter of the satellite (deduced from the size and distance of the sun) to be 5197 miles. I do not know whether this magnitude

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is at all reconcileable with its mass (if ascertained), under any probable hypothesis of density; but it has occurred to me that careful measures of the shadows of the satellites of *Jupiter* would afford the most likely means of getting at their real magnitudes, and I propose to take every opportunity of making such observations."

Additional Observations of the Phenomena of Jupiter and his Satellites, with the Twenty-foot Equatoreal. By Mr. Lassell.

"1850, March 10, M.T. 10^{h} 40^{m}. Air less disturbed than usual. Power 316. The view of the planet uncommonly fine, with occasional intervals of atmospheric agitation. The central bright part of *Jupiter* is mottled or curdled, and indeed scarcely any part of his surface is of uniform texture.

"The southern portion is covered nearly up to the edge of the principal belt with a decided shade. With power 430 the third satellite is certainly not round, but the atmosphere is not fine enough for scrutinising satellites with this power. The fourth and third satellites are very near each other, and pretty well removed from *Jupiter*. The fourth is much paler than the third. The first satellite is obviously larger than the second — scarcely, I think, so bright.

"March 12, G.M.T. 11^{h} 25^{m}, power 430. The air is unusually fine. I think I never saw so fine, so powerful a view of *Jupiter*. The third satellite is approaching the following limb of the planet, whose light, diminishing the brightness and radiation of the satellite, enables me to see it with admirable distinctness. There is certainly a *spot* on the satellite's disk, in the north preceding quadrant. Its disk also seems a little flattened on the following side.

G.M.T. h	m	s	
12	6	34.	The limbs of the 3d satellite and *Jupiter* are in contact.
12	8	30.	The satellite appears now the most beautiful round disk, and I am certain of seeing the spot upon it.
12	11	48.	The satellite bisected by *Jupiter's* limb.
12	16	6.	The following limbs of the planet and satellite in contact.
12	18	30.	The satellite is now a large *bright* round spot on the face of *Jupiter*, just within the limb.
12	21	30.	The satellite is getting fainter. I see nothing yet of the shadow. The satellite enters between two rather faint belts.
12	24	30.	I only see the satellite by glimpses. I have not yet caught sight of the shadow.
12	29	6.	I caught the first glimpse of the shadow.